DEKRA Testing and Certification, S.A.U.
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C.I.F. A29 507 456

FCC LISTED,
REGISTRATION NUMBER:
720267

ISED LISTED
REGISTRATION NUMBER
4621A-2 & 4

Test report No:

NIE: 57623RRF.003

Test report

USA FCC Part 15.247, 15.209
CANADA RSS-247, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.
Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.
General Requirements and Information for the Certification of Radio Apparatus.

Identification of item tested	SDCM
Trademark	Valeo
Model and /or type reference	SD1A
Other identification of the product	FCC ID: N5F-SD1A
Features	Not provided data
Applicant	VALEO COMFORT & DRIVING ASSISTANCE SYSTEMS, SAS. 76, Rue Auguste Perret, 94046 Créteil CEDEX, FRANCE
Test method requested, standard	USA FCC Part 15.247 10-1-17 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 10-1-17 Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (April 2018). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05 dated August 24, 2018. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

Approved by (name / position & signature)	A. Llamas RF Lab. Manager Firmado digitalmente por ALEJANDRO LLAMAS RODRIGUEZ Fecha: 2018.11.07 17:42:09 +01'00'
Date of issue	2018-11-07
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Competences and guarantees

DEKRA Testing and Certification is a testing laboratory accredited by the National Accreditation Body (ENAC - Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

DEKRA Testing and Certification is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: ISED 4621A-2 & 4.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification at the time of performance of the test.

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The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification internal document PODT000.

Usage of samples

Samples undergoing test have been selected by: the client.

Sample M/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
57623B/036	Module with antenna connector	SD1A	---	2018-08-14

1. Sample M/01 has undergone the following test(s):

All conducted tests indicated in Appendix A.

Sample M/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
57623B/163	Smart ECU	SD1A	---	2018-09-18
57623B/080	Antennas	---	---	2018-08-16
57623B/081	Antennas	---	---	2018-08-16
57623B/085	Harness	---	---	2018-08-27
57623B/084	Connection accessory	---	---	2018-08-27

1. Sample M/02 has undergone the following test(s):

All radiated tests indicated in Appendix A.

Sample M/03 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
57623B/132	Smart ECU	SD1A	---	2018-08-27
57623B/080	Antennas	---	---	2018-08-16
57623B/081	Antennas	---	---	2018-08-16
57623B/085	Harness	---	---	2018-08-27
57623B/084	Connection accessory	---	---	2018-08-27

1. Sample M/03 has undergone the following test(s):

All co-location radiated tests indicated in Appendix A.

Test sample description

Description of product.....:	Smart ECU for keyless car access and start	
Rated power supply.....:	Voltage and Frequency	
	☐	AC:
	☒	DC: 12 Vdc.
Software version.....:	5.01	
Hardware version.....:	b103475-A	
Mounting position.....:	☐	Table top equipment
	☐	Wall/Ceiling mounted equipment
	☐	Floor standing equipment
	☐	Hand-held equipment
	☒	Other: Car Equipment

Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	Laptop (57623B/083)	---	LENOVO

Identification of the client

VALEO COMFORT & DRIVING ASSISTANCE SYSTEMS, SAS

76 rue Auguste Perret, 94046 Créteil CEDEX, FRANCE

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2018-09-18
Date (finish)	2018-10-11

Document history

Report number	Date	Description
57623RRF.003	2018-11-07	First release

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 35 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

Remarks and comments

The tests have been performed by the technical personnel: Ignacio Cabra and Miguel Ángel Torres.

Used instrumentation:

Conducted Measurements

		Last Cal. date	Cal. due date
1.	Spectrum analyser Rohde & Schwarz FSV40	2018/02	2020/02
2.	DC power supply Agilent Technologies N5770A	---	---
3.	Type-K thermocouple FLUKE 80PK-1	2017/07	2018/07

Radiated Measurements

		Last Cal. date	Cal. due date
1.	Semianechoic Absorber Lined Chamber ETS FACT3 200STP	N.A.	N.A.
2.	BiconicalLog antenna ETS LINDGREN 3142E	2017/04	2020/04
3.	Multi Device Controller EMCO 2090	N.A.	N.A.
4.	Multi Device Controller MESSTECHNIK DAV-RR	N.A.	N.A.
5.	Active Loop Antenna 9 kHz-30 MHz HEWLETT PACKARD 11966A	2018/06	2020/06
6.	Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2016/11	2019/11
7.	Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2017/03	2020/03
8.	EMI Test Receiver R&S ESU26	2018/02	2020/02
9.	EMI Test Receiver R&S ESR7	2017/08	2019/08
10.	Spectrum analyser Rohde & Schwarz FSW50	2018/02	2020/02
11.	Spectrum analyser Rohde & Schwarz FSV40	2018/02	2020/02
12.	RF pre-amplifier 30 MHz-6 GHz Bonn Elektronik BLNA 0360-01N	2018/07	2019/07
13.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-3A	2018/03	2019/03
14.	RF pre-amplifier 18-40 GHz NARDA JS44-18004000-33-8P	2018/02	2019/02

Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

Summary

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		**Verdict**	**Remark**
Section 15.247 Subclause (a) (2) / RSS-247 5.2. (a)	6 dB Bandwidth	P	
Section 15.247 Subclause (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P	
Section 15.247 Subclause (d) / RSS-247 5.5	Emission limitations conducted (Transmitter)	P	
Section 15.247 Subclause (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	P	
Section 15.247 Subclause (e) / RSS-247 5.2. (b)	Power spectral density	P	
Section 15.247 Subclause (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	(1)

Supplementary information and remarks:

(1) The device has two antennas, antenna 1 and antenna 2, with -2 dBi and -1.5 dBi maximum gain, respectively. The device does not transmit with both antennas simultaneously. After a preliminary test, antenna 2 was selected as worst case for radiated spurious emissions.

Appendix A: Test results.

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TEST CONDITIONS

Power supply (V):

Vnominal = 12 Vdc

Type of power supply = DC voltage from battery.

Type of antenna = integral antennas.

Declared Gain for antenna (maximum) = -2 dBi (antenna 1) and -1.5 dBi (antenna 2)

TEST FREQUENCIES:

Lowest channel: 2402 MHz

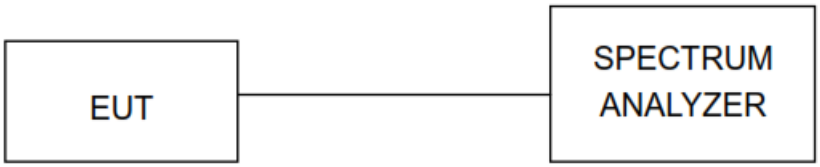
Middle channel: 2440 MHz

Highest channel: 2480 MHz

The sample was used to configure the EUT to continuously transmit at a specified output power in all channels.

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is directly connected to the spectrum analyzer.



RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 9 kHz to 30 MHz (Loop antenna for the range between 9 kHz to 30 MHz) 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

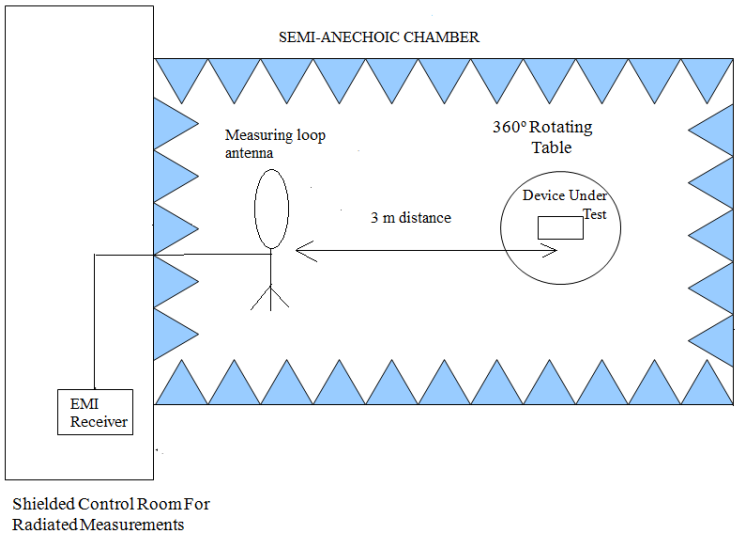
For radiated emissions in the range 9 kHz to 30 MHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 40 dB per decade is used to normalize the measured data for determining compliance.

For radiated emissions in the range 1 GHz to 25 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

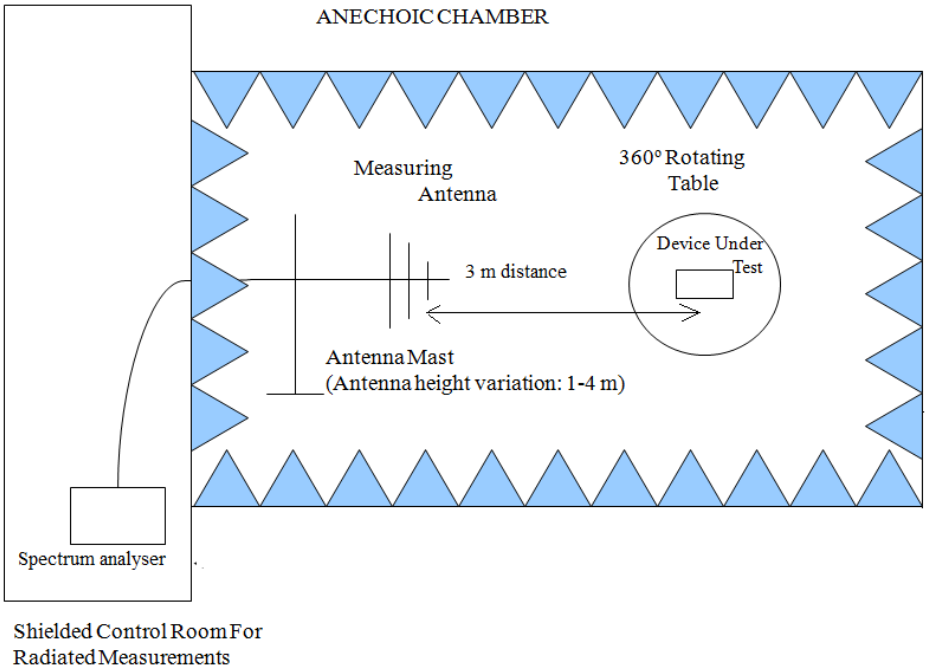
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

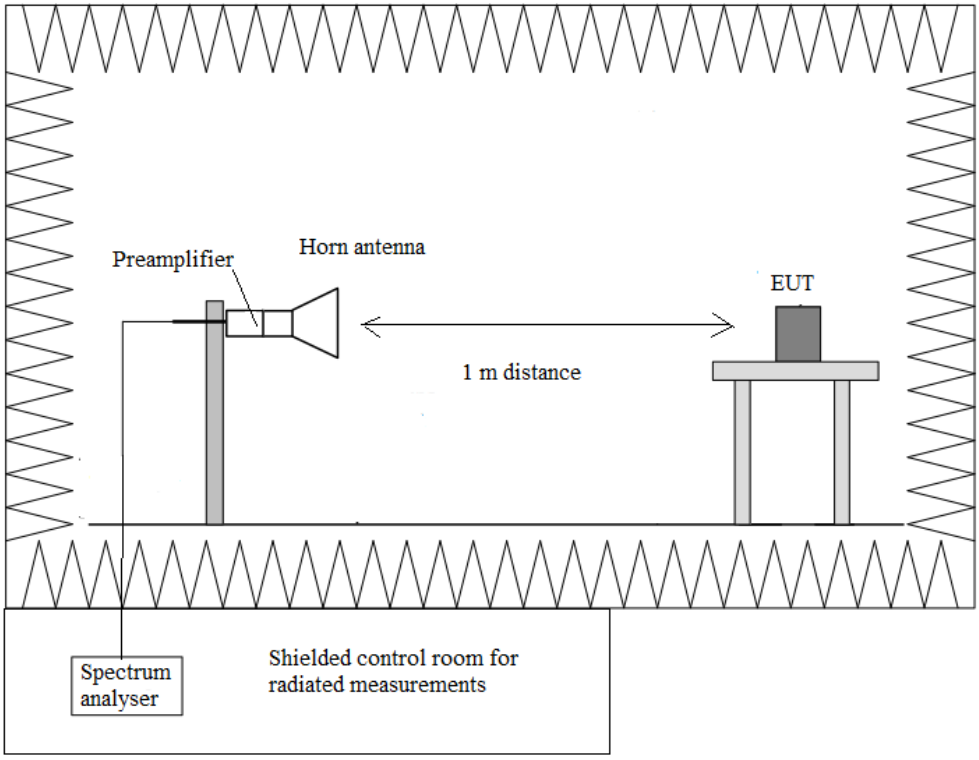
Radiated measurements setup f ≤ 30 MHz



Radiated measurements setup 30 MHz ≤ f ≤ 1 GHz



Radiated measurements setup f > 1 GHz



The test was performed with the equipment transmitting first with only the 2.4 GHz BT LE radio and repeated with the 125 kHz radio transmitting simultaneously to check the impact of the co-location of the other radio interface. The results and plots below show the worst results obtained.

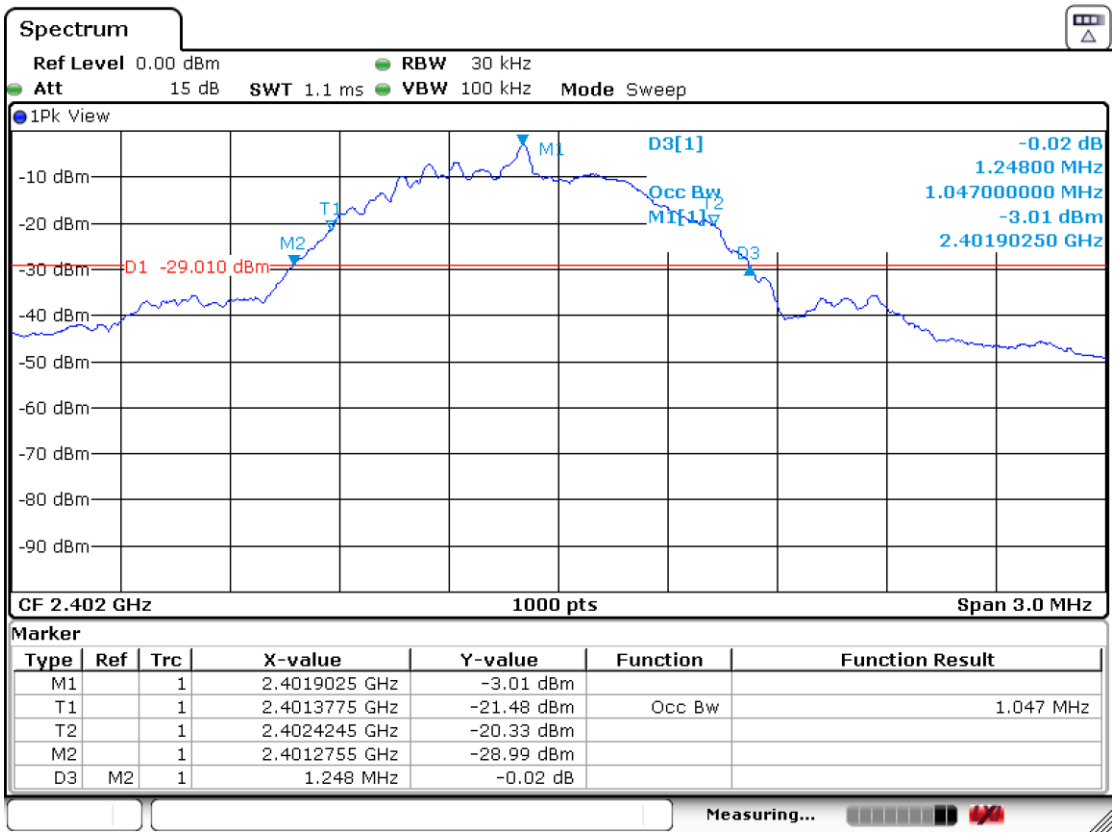
Occupied Bandwidth

RESULTS:

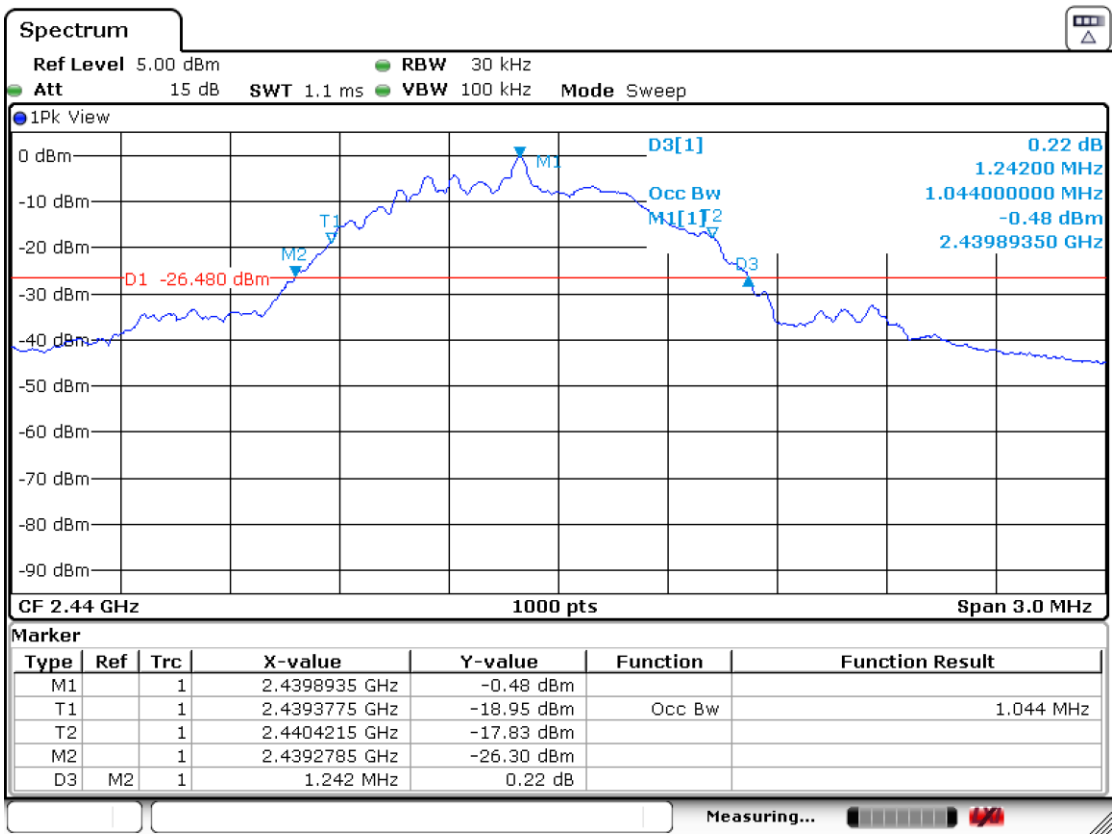
(see next plots).

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
99% bandwidth (MHz)	1.047	1.044	1.056
-26 dBc bandwidth (MHz)	1.248	1.242	1.254
Measurement uncertainty (kHz)	<± 1.88		

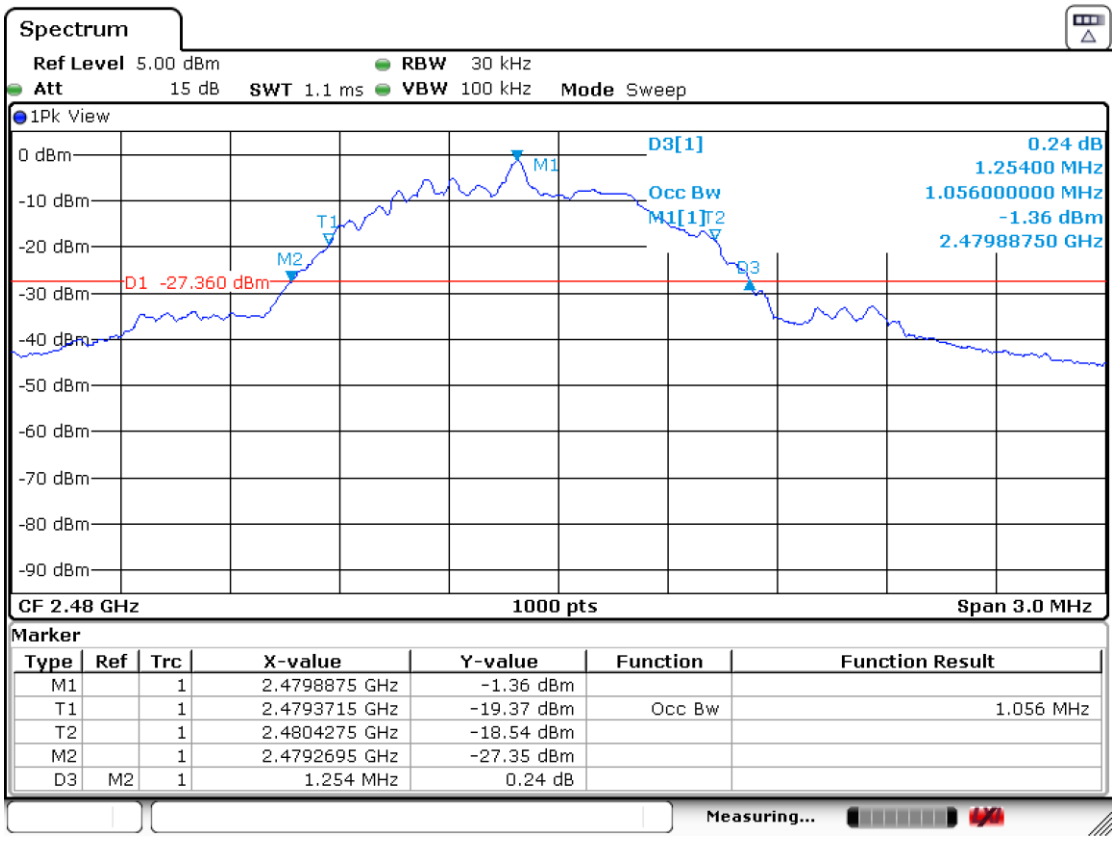
Lowest Channel



Middle Channel



Highest channel



Section 15.247 Subclause (a) (2) / RSS-247 5.2. (a). 6 dB Bandwidth

SPECIFICATION

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS:

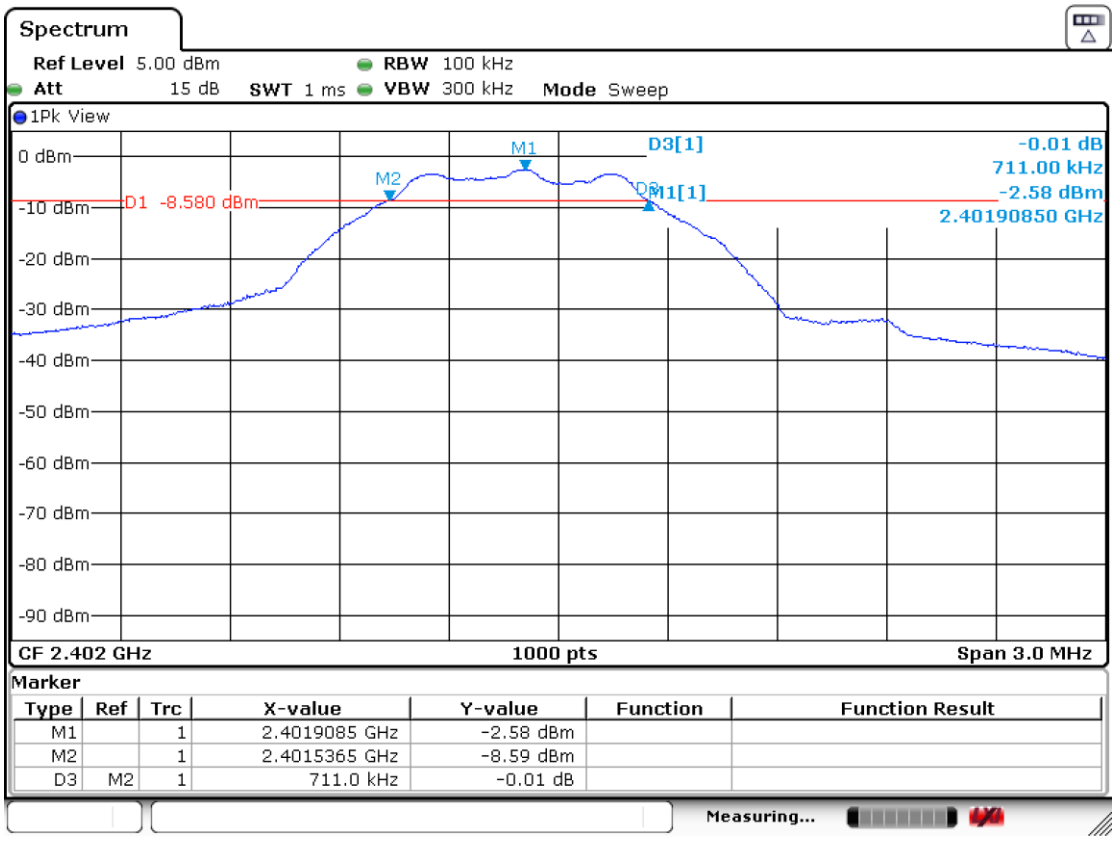
6 dB Bandwidth (see next plots).

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
6 dB Spectrum bandwidth (kHz)	711.0	705.0	735.0
Measurement uncertainty (kHz)	<± 2.5		

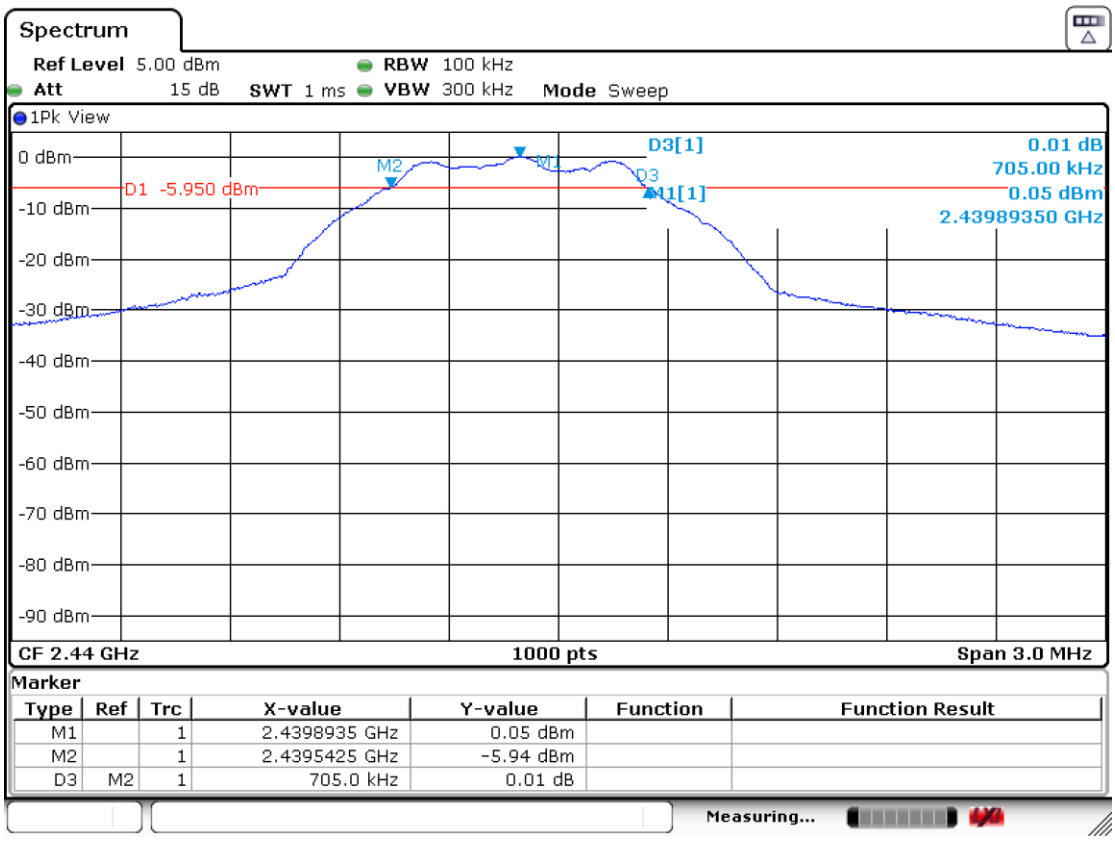
Verdict: PASS

6 dB BANDWIDTH.

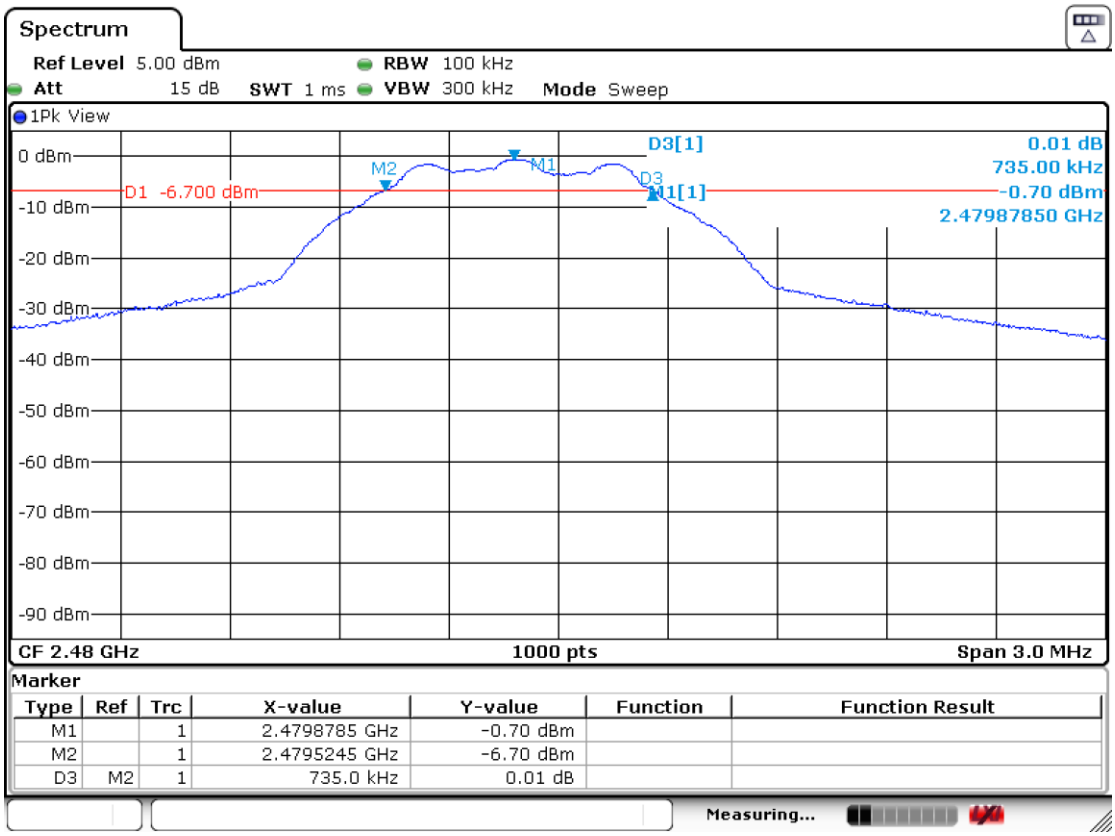
Lowest Channel



Middle Channel



Highest Channel



Section 15.247 Subclause (b) / RSS-247 5.4. (d). Maximum output power and antenna gain

SPECIFICATION

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS:

The maximum peak conducted output power was measured using the method according to point 9.1.1. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v05 dated 24/08/2018.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

MAXIMUM OUTPUT POWER. See next plots.

Maximum declared antenna gain: -2 dBi (antenna 1) and -1.5 dBi (antenna 2)

Antenna 1

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Maximum conducted power (dBm)	-2.43	0.14	-0.59
Maximum EIRP power (dBm)	-4.43	-1.86	-2.59
Measurement uncertainty (dB)	<± 0.28		

Antenna 2

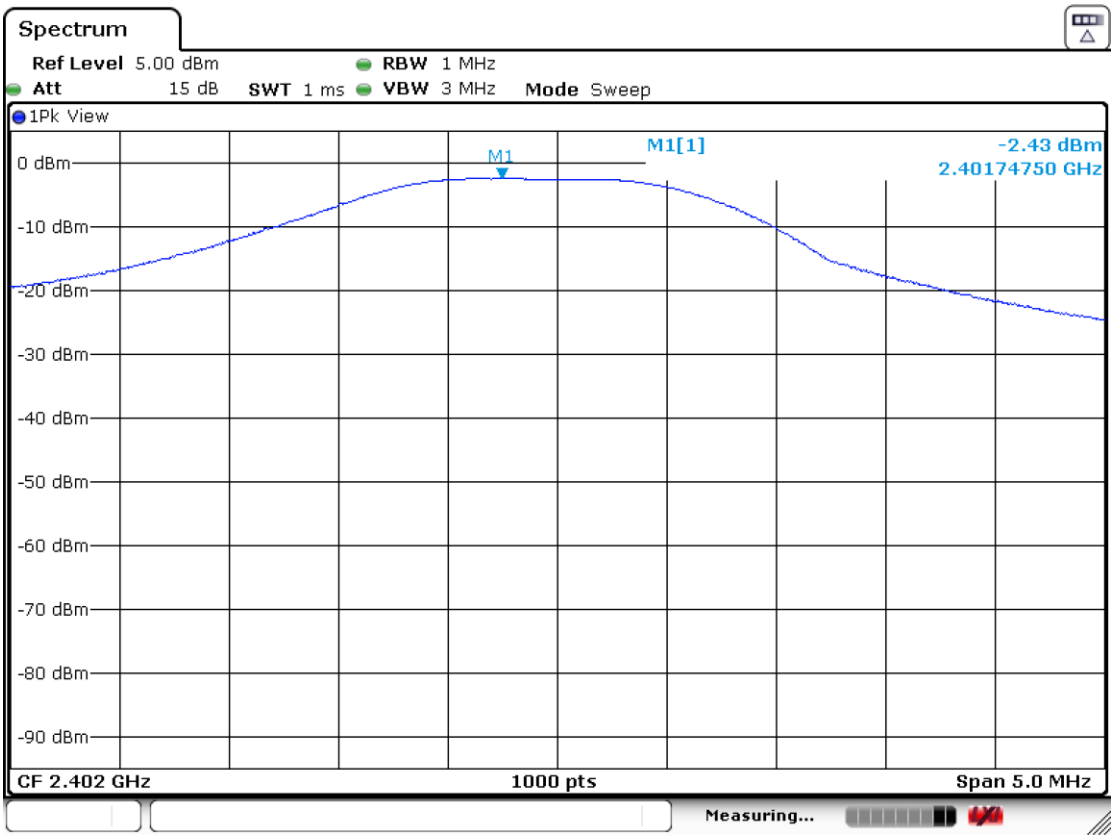
	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Maximum conducted power (dBm)	-2.43	0.14	-0.59
Maximum EIRP power (dBm)	-3.93	-1.36	-2.09
Measurement uncertainty (dB)	<± 0.28		

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

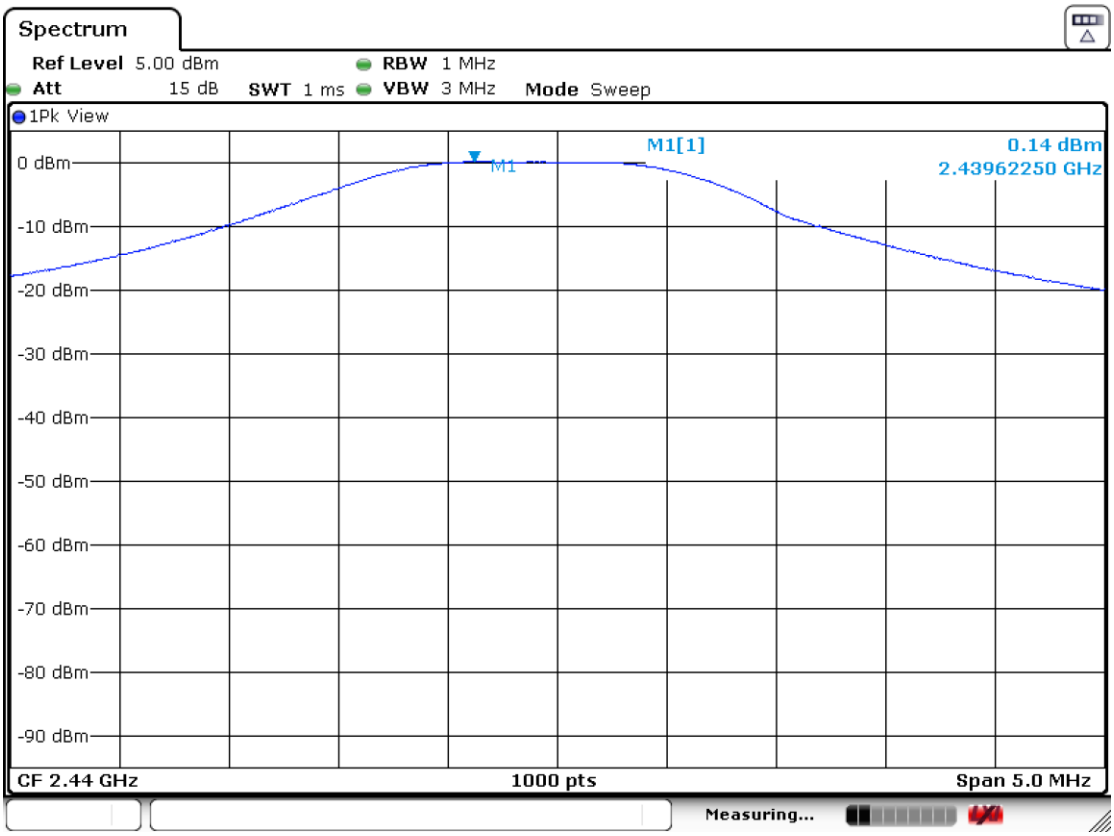
Verdict: PASS

CONDUCTED PEAK POWER.

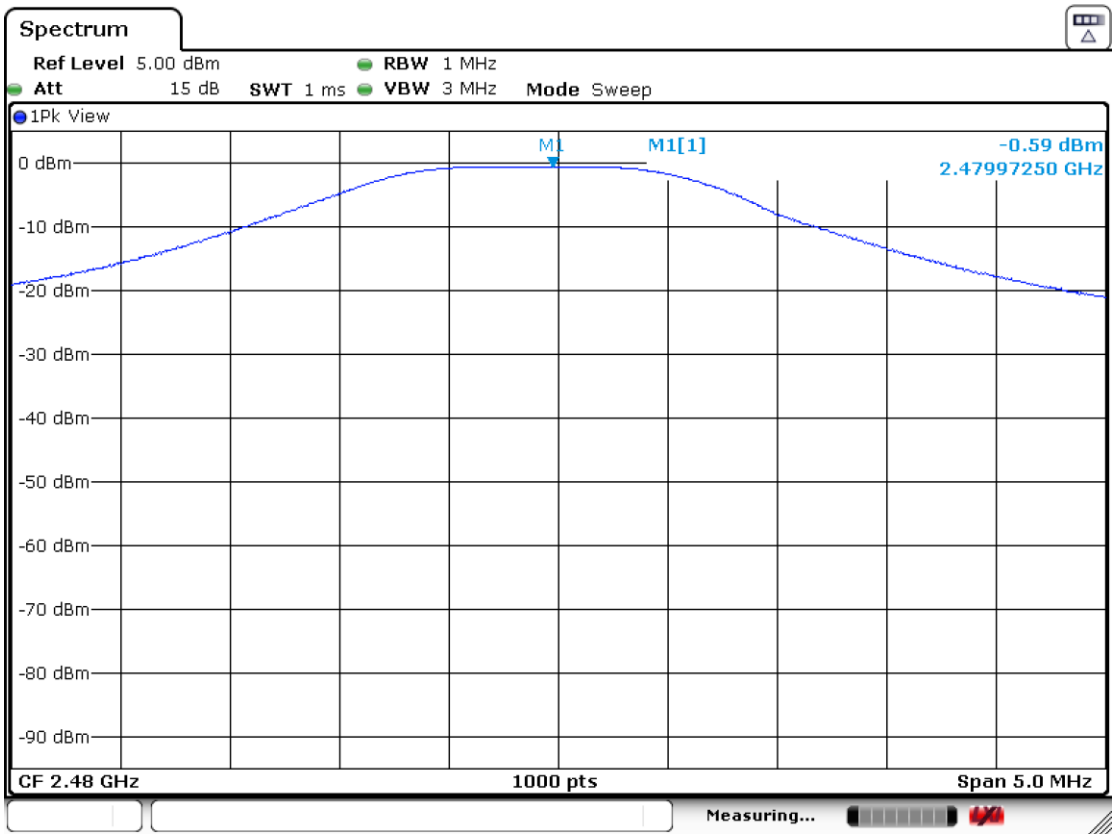
Lowest frequency



Middle frequency



Highest frequency



Section 15.247 Subclause (d) / RSS-247 5.5. Emission limitations conducted (Transmitter)

SPECIFICATION

In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

RESULTS:

Reference Level Measurement

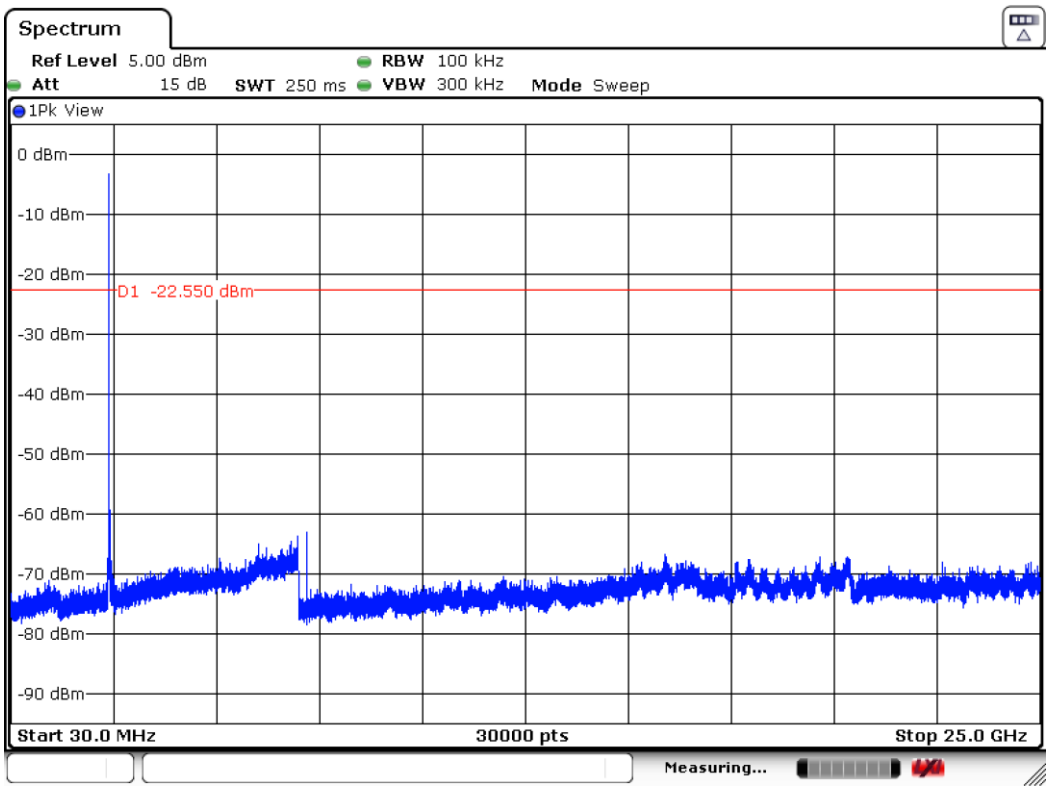
	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Reference Level Measurement (dBm)	-2.55	0.08	-0.7
Measurement uncertainty (dB)	<± 0.28		

No radiated spurious emissions were found at less than 20 dB respect to the limit.

Measurement uncertainty (dB): < 0.28

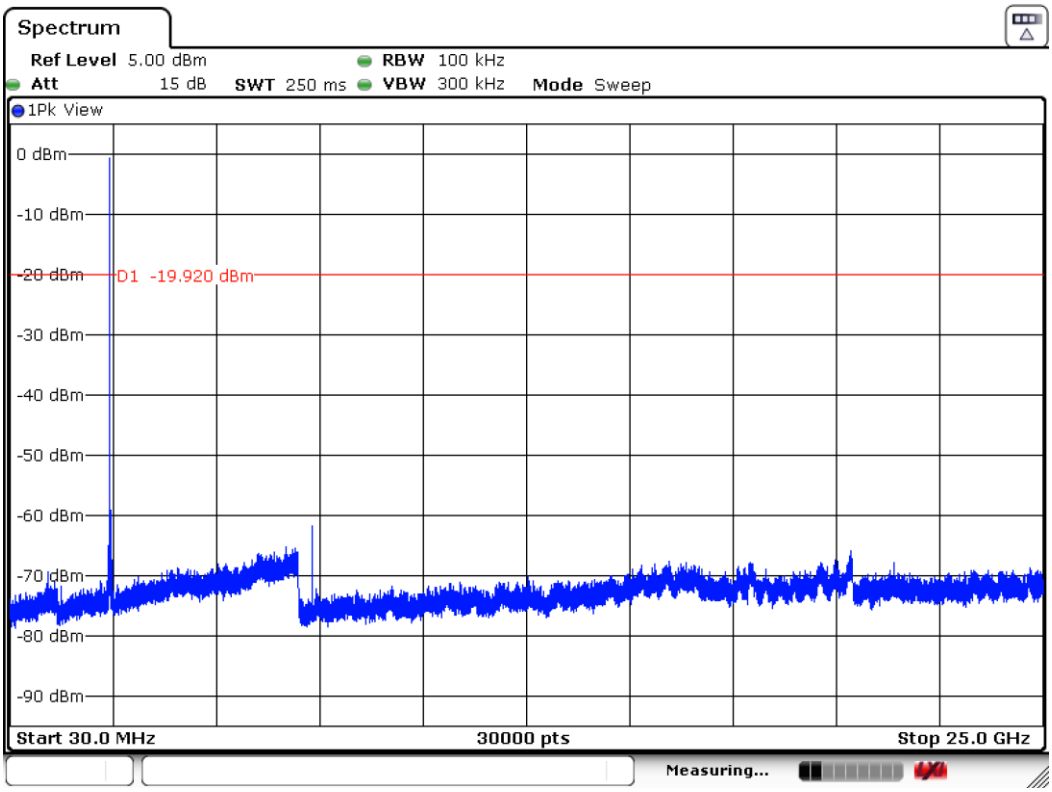
Verdict: PASS

Lowest frequency



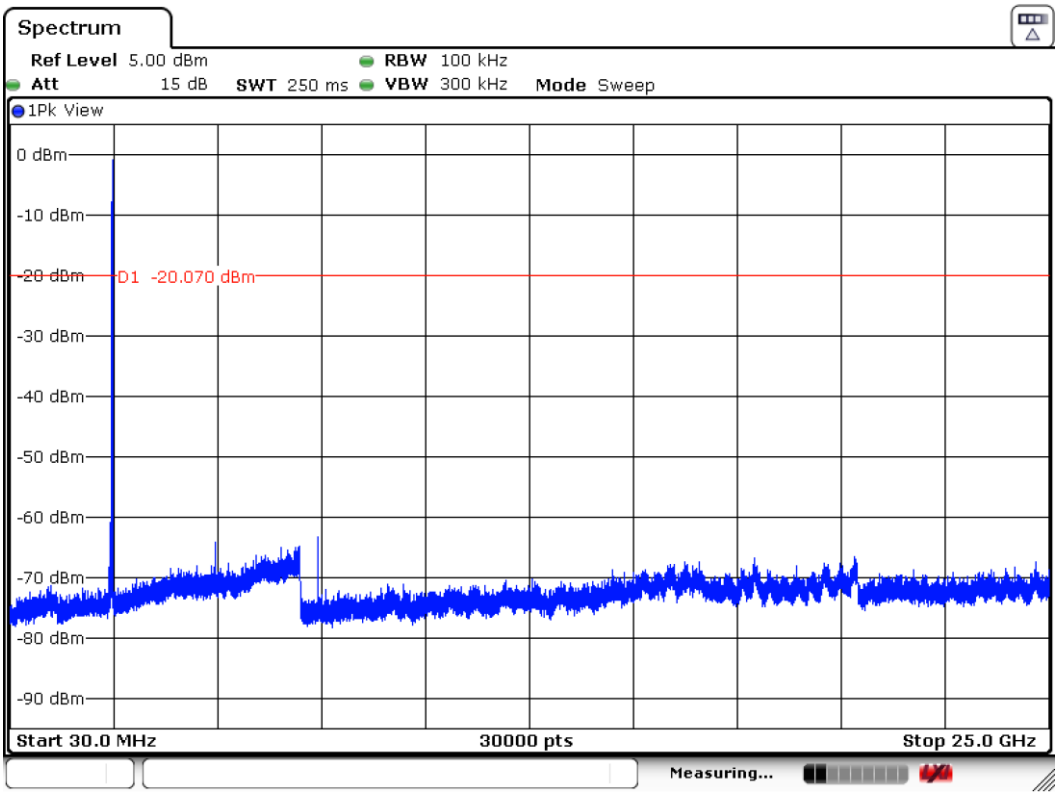
Note: The peak shown in the plot above the limit is the carrier frequency.

Middle frequency



Note: The peak shown in the plot above the limit is the carrier frequency.

Highest frequency



Note: The peak shown in the plot above the limit is the carrier frequency.

Section 15.247 Subclause (d) / RSS-247 5.5. Band-edge emissions compliance (Transmitter)

SPECIFICATION

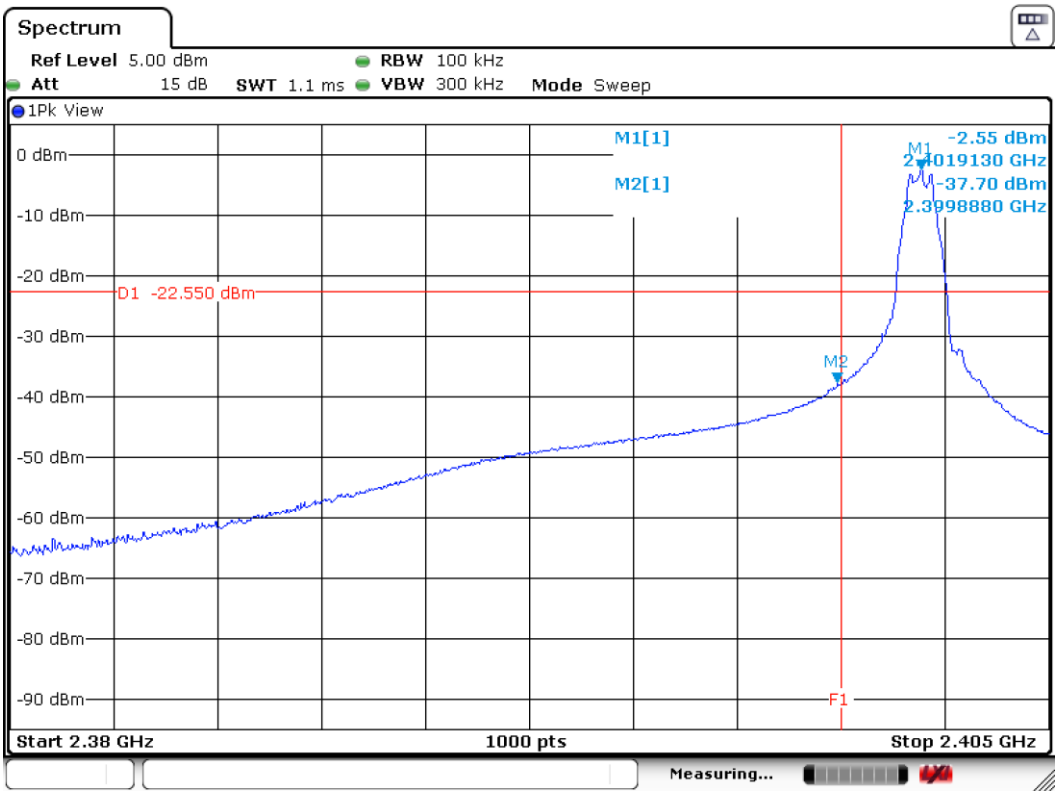
In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

RESULTS:

Note: Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

1. LOW FREQUENCY SECTION. CONDUCTED.

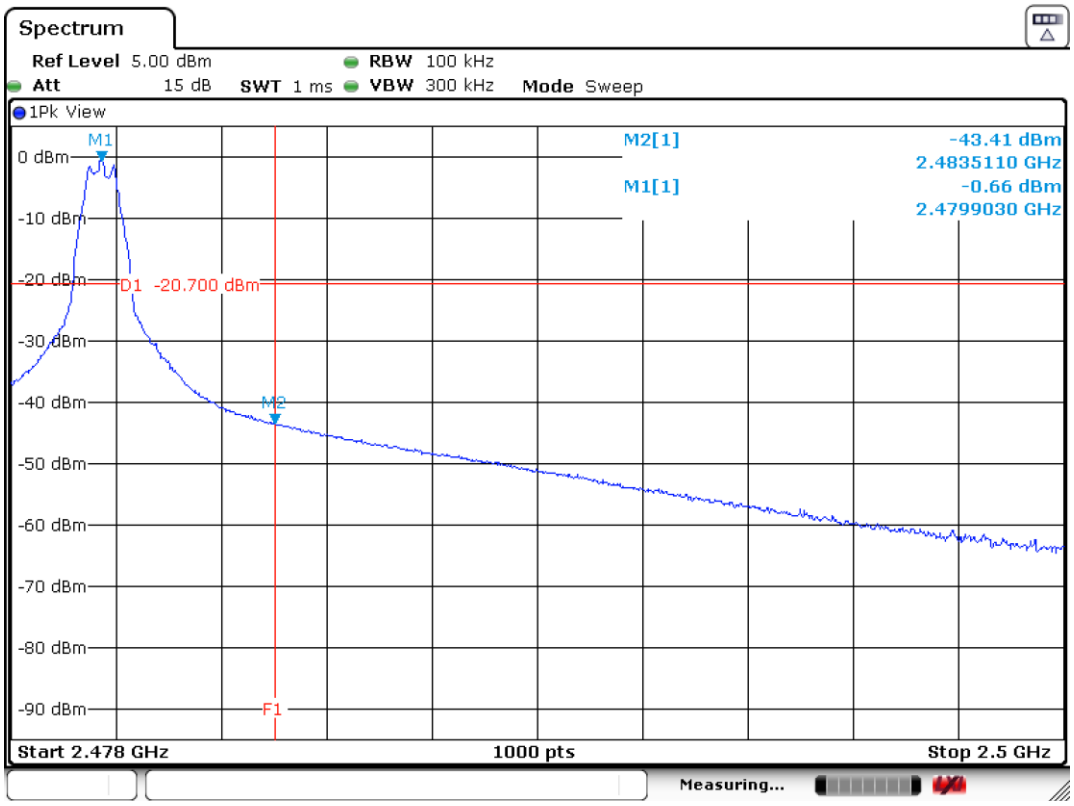
See next plot.



Verdict: PASS

2. HIGH FREQUENCY SECTION. CONDUCTED.

See next plot.



Measurement uncertainty (dB)	< ± 0.28

Verdict: PASS

Section 15.247 Subclause (e) / RSS-247 5.2. (b) Power spectral density

SPECIFICATION

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS:

The maximum power spectral density level in the fundamental emission was measured using the method PKPSD (Peak PSD) according to point 10.2. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v04 v05 dated 24/08/2018.

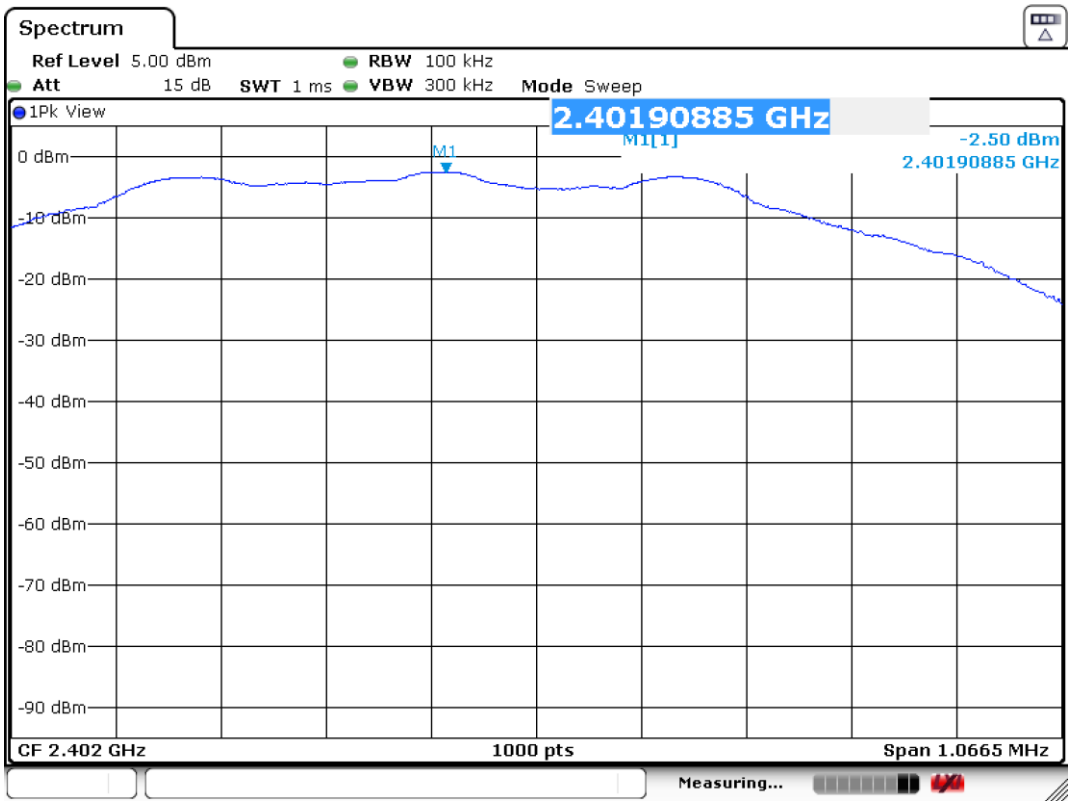
Power spectral density (see next plots).

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Power spectral density (dBm)	-2.5	0.08	-0.68
Measurement uncertainty (dB)	<± 0.28		

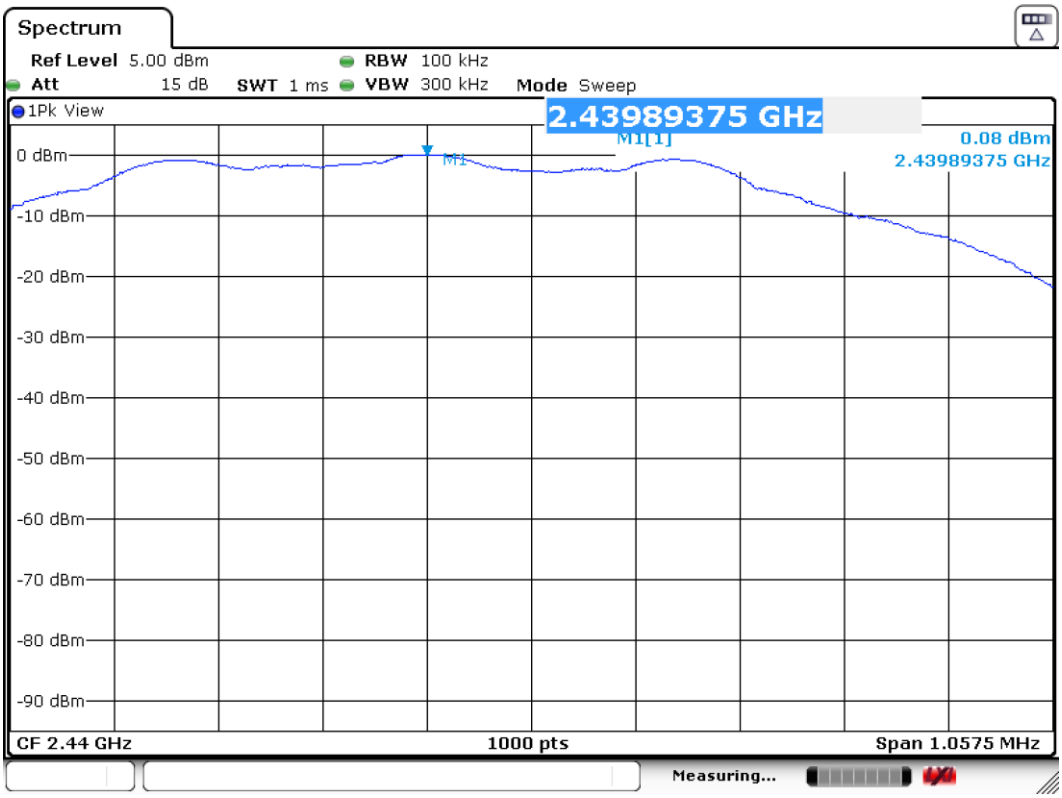
Verdict: PASS

POWER SPECTRAL DENSITY

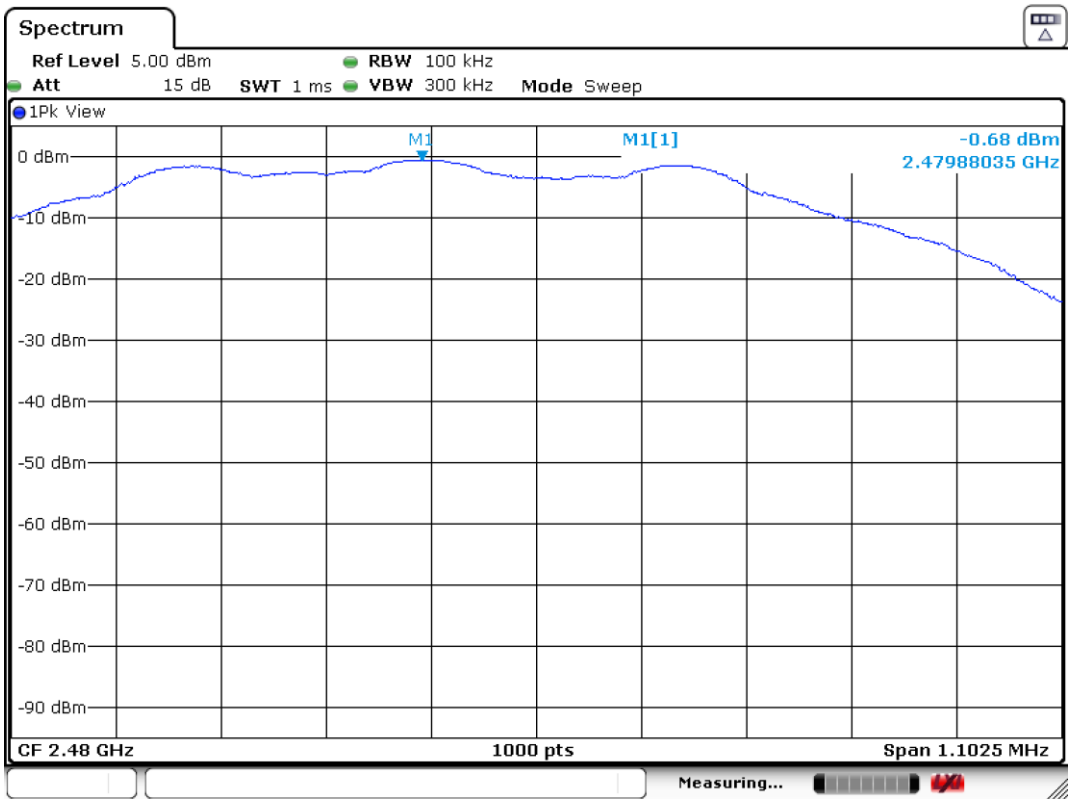
Lowest Channel



Middle Channel



Highest Channel



Section 15.247 Subclause (d) / RSS-247 5.5. Emission limitations radiated (Transmitter)

SPECIFICATION

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c) / RSS-Gen):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters (when applicable) to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 9 kHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

The device has two antennas, antenna 1 and antenna 2, with -2 dBi and -1.5 dBi maximum gain, respectively. The device does not transmit with both antennas simultaneously. After a preliminary test, antenna 2 was selected as worst case for radiated spurious emissions.

Frequency range 9 kHz-30 MHz

Frequency (kHz)	Maximum field strength (dBµV/m) measured at 3 m (average detector)	Maximum field strength (dBµV/m) extrapolated to 300 m (40 dB/decade)	Maximum field strength (µV/m) extrapolated to 300 m (40 dB/decade)	Limit (µV/m)
125.400 (*)	86.60	6.60	2.14	19.14
Measurement uncertainty (dB)	<±3.61			

(*): Fundamental emission of the 125 kHz radio.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (average detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)	Maximum field strength (µV/m) extrapolated to 30 m (40 dB/decade)	Limit (µV/m)
0.626	53.30	13.30	4.62	38.34
0.878	47.60	7.60	2.40	27.33
28.710	45.50	5.50	1.88	30
Measurement uncertainty (dB)	<±3.61			

Frequency range 30 MHz-1000 MHz

The spurious signals detected do not depend on the operating channel.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
30.950	V	Quasi-Peak	18.30	<± 3.88
124.720	V	Quasi-Peak	18.90	<± 3.88

Frequency range 1 GHz-25 GHz

The results in the next tables show the maximum measured levels in the 1-25 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

Spurious signals with peak levels above the average limit (54 dBµV/m at 3 m) are measured with average detector for checking compliance with the average limit.

Lowest Channel

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2.389887	H	Peak	64.76	<± 3.70
		Average	40.35	<± 3.70
4.803900	V	Peak	40.16	<± 3.70
7.205830	V	Peak	45.54	<± 3.70

Middle Channel

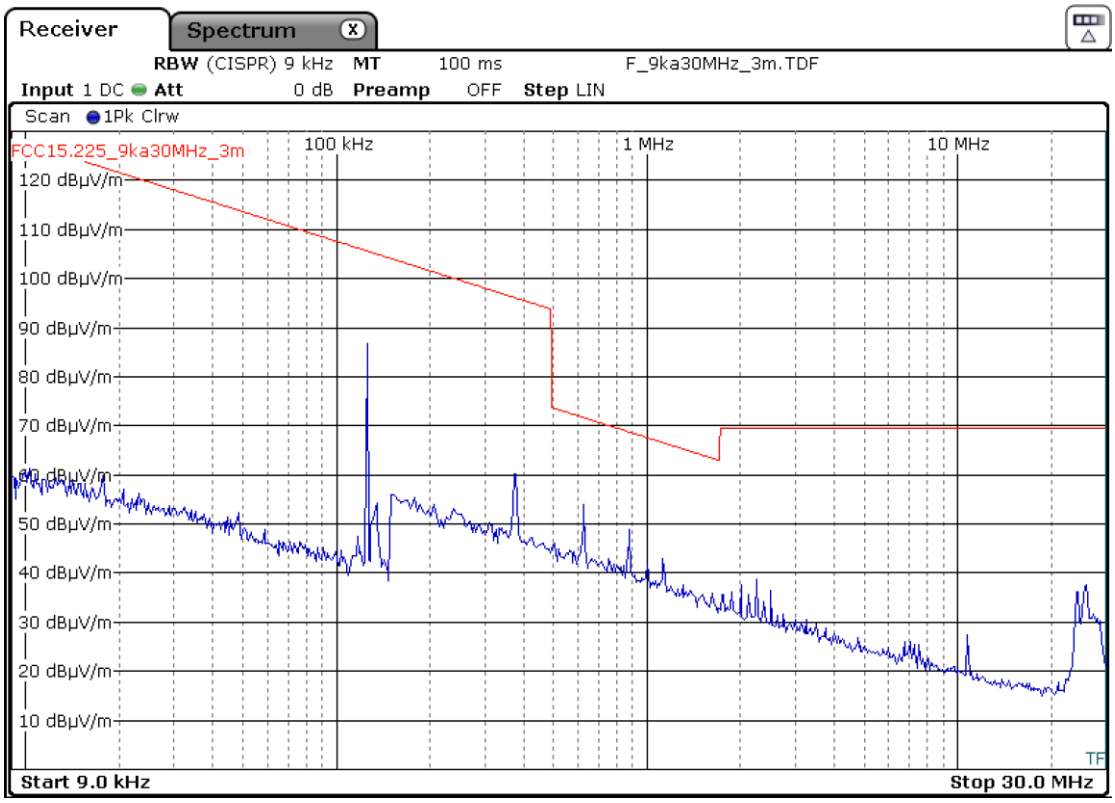
Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2.389455	H	Peak	52.04	<± 3.70
2.484829	H	Peak	53.62	<± 3.70
4.879500	H	Peak	41.46	<± 3.70
7.319230	V	Peak	45.84	<± 3.70

Highest Channel

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2.483509	H	Peak	73.71	<± 3.70
		Average	45.11	<± 3.70
4.959770	H	Peak	44.05	<± 3.70
7.439630	V	Peak	46.73	<± 3.70

Verdict: PASS

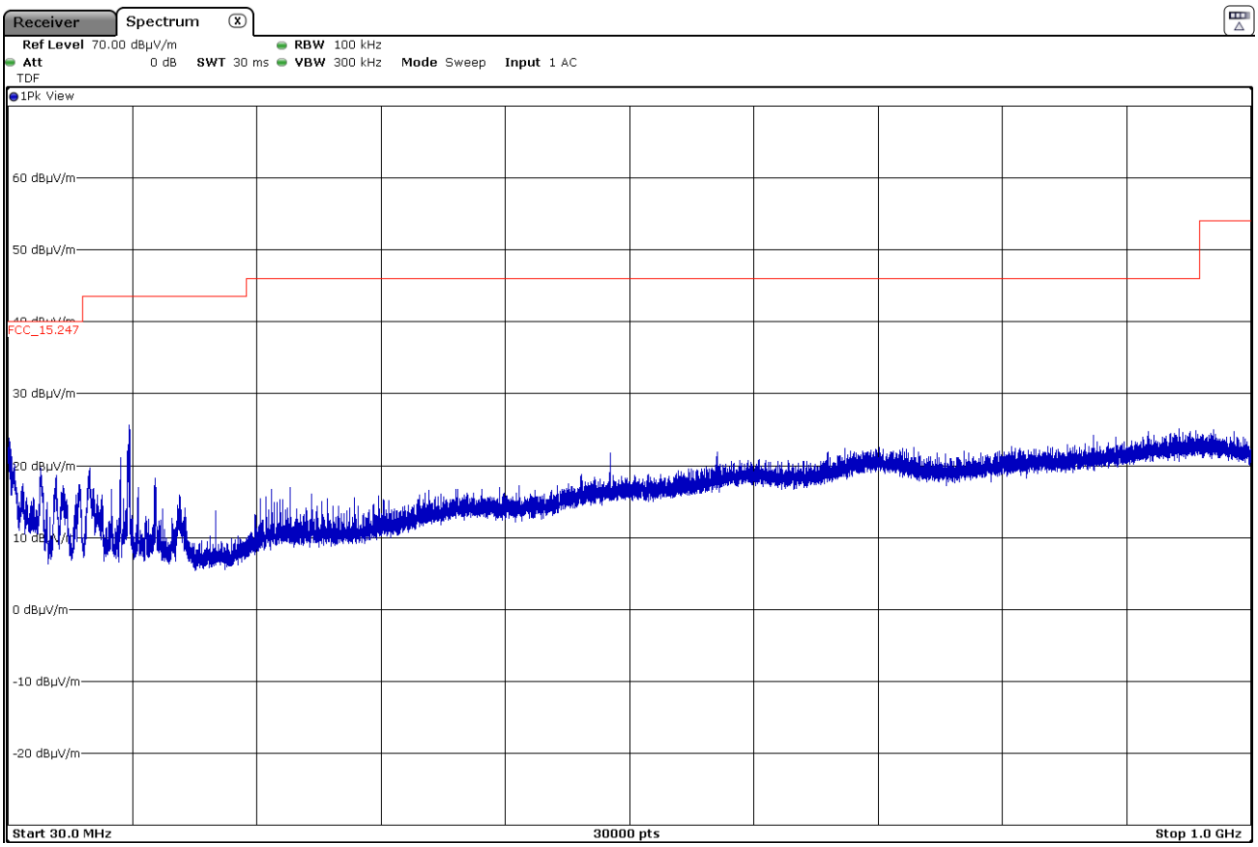
FREQUENCY RANGE 9 kHz-30 MHz



Resolution bandwidth:
200 Hz for 9 kHz ≤ f ≤ 150 kHz
9 kHz for 150 kHz ≤ f ≤ 30 MHz

Note: The scan is performed with a peak detector.
The limits shown in the above plot are extrapolated to 3 meters.

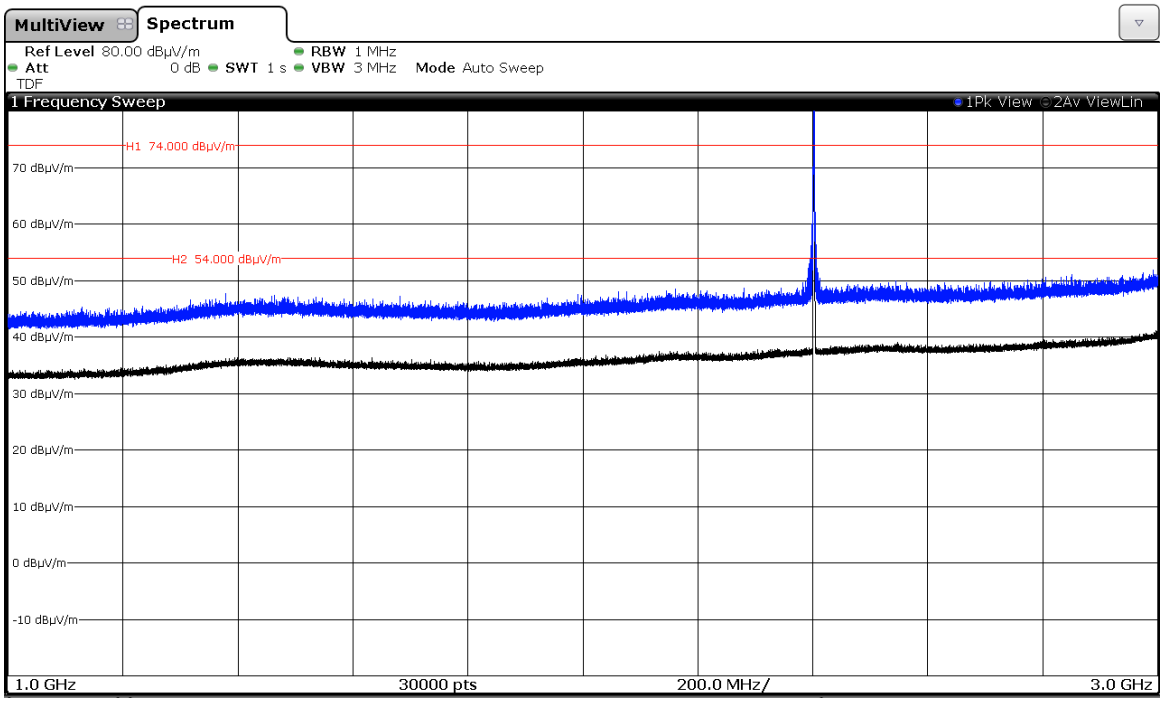
FREQUENCY RANGE 30 MHz-1000 MHz.



(This plot is valid for all three channels).

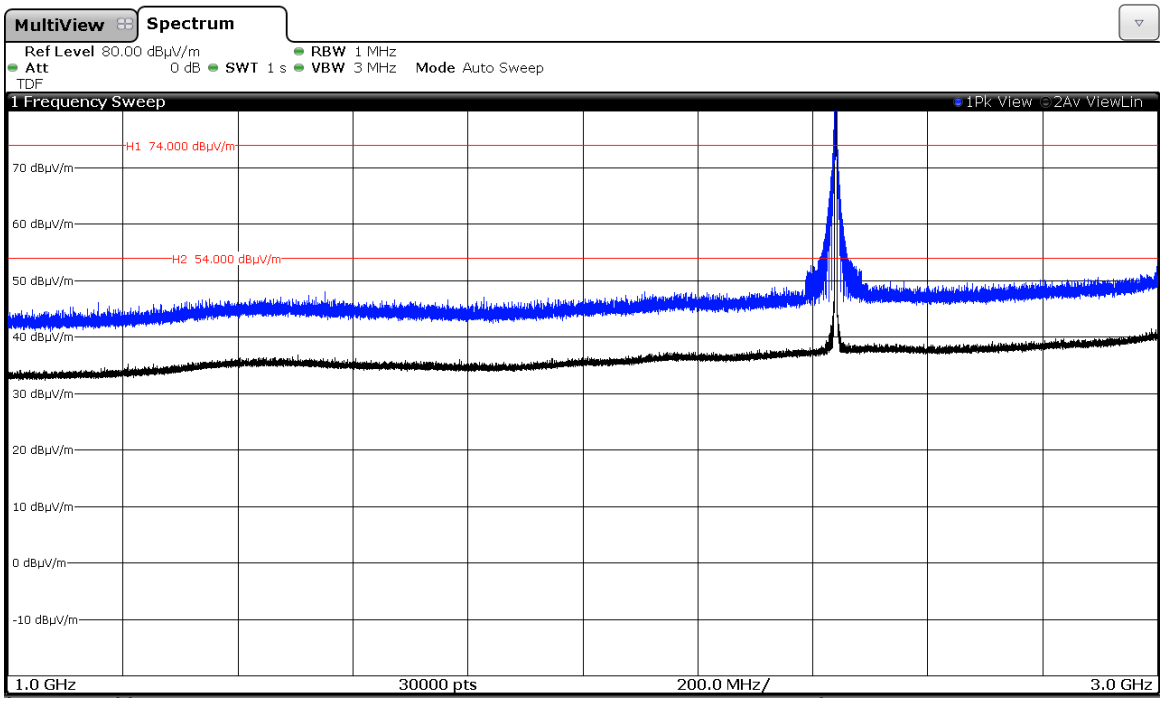
FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: Lowest (2402 MHz).



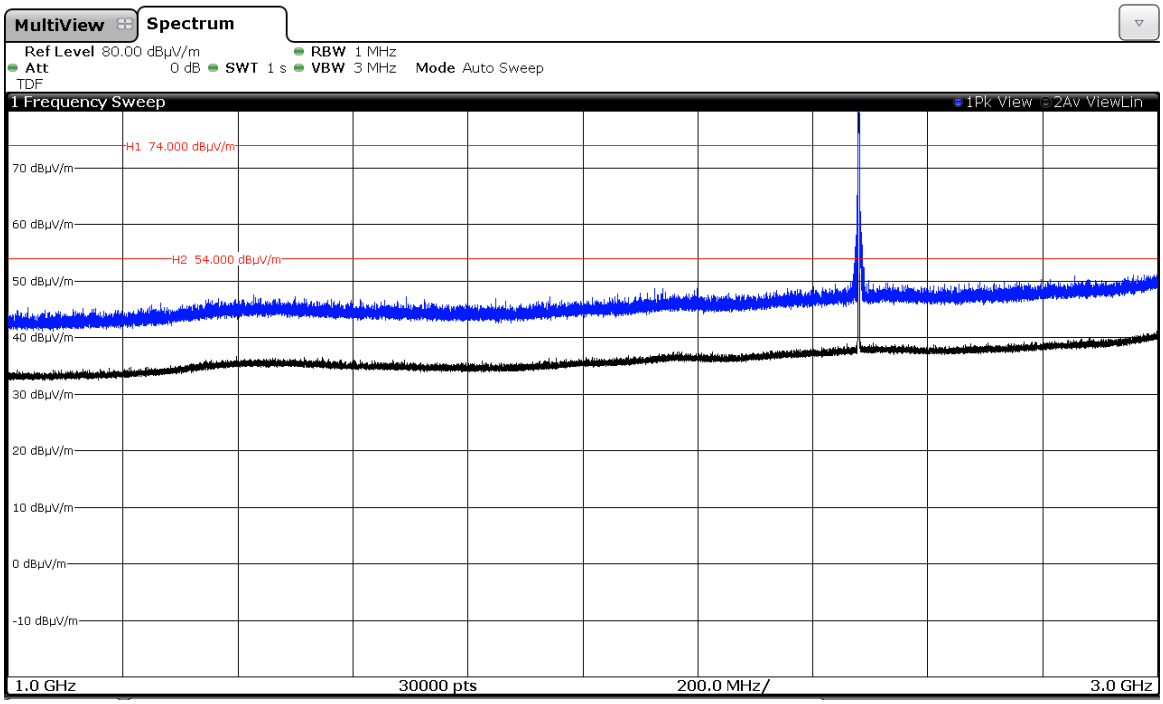
Note: The peak shown in the plot above the limit is the carrier frequency.

CHANNEL: Middle (2440 MHz).



Note: The peak shown in the plot above the limit is the carrier frequency.

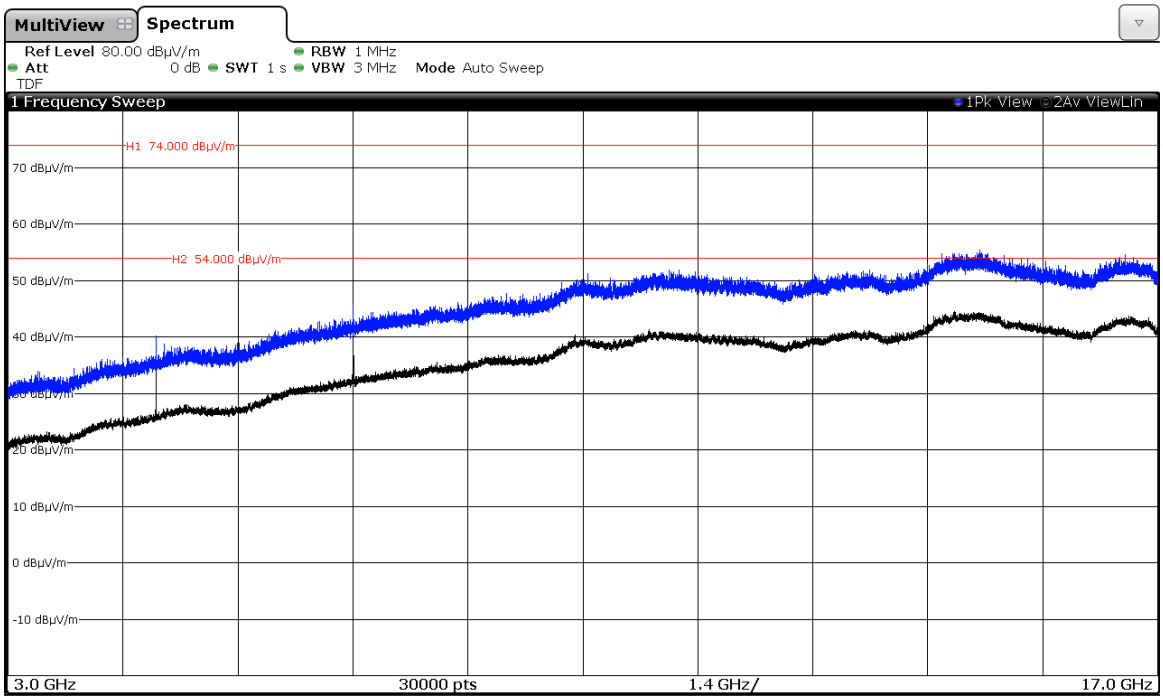
CHANNEL: Highest (2480 MHz).



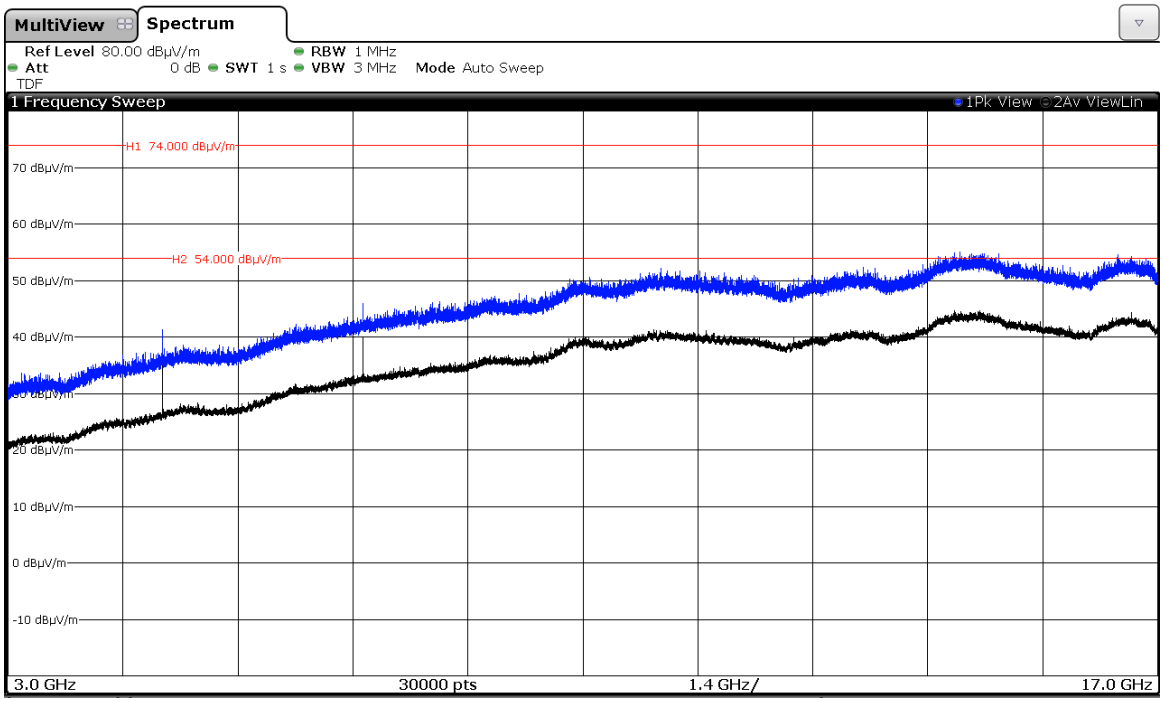
Note: The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 3 GHz to 17 GHz.

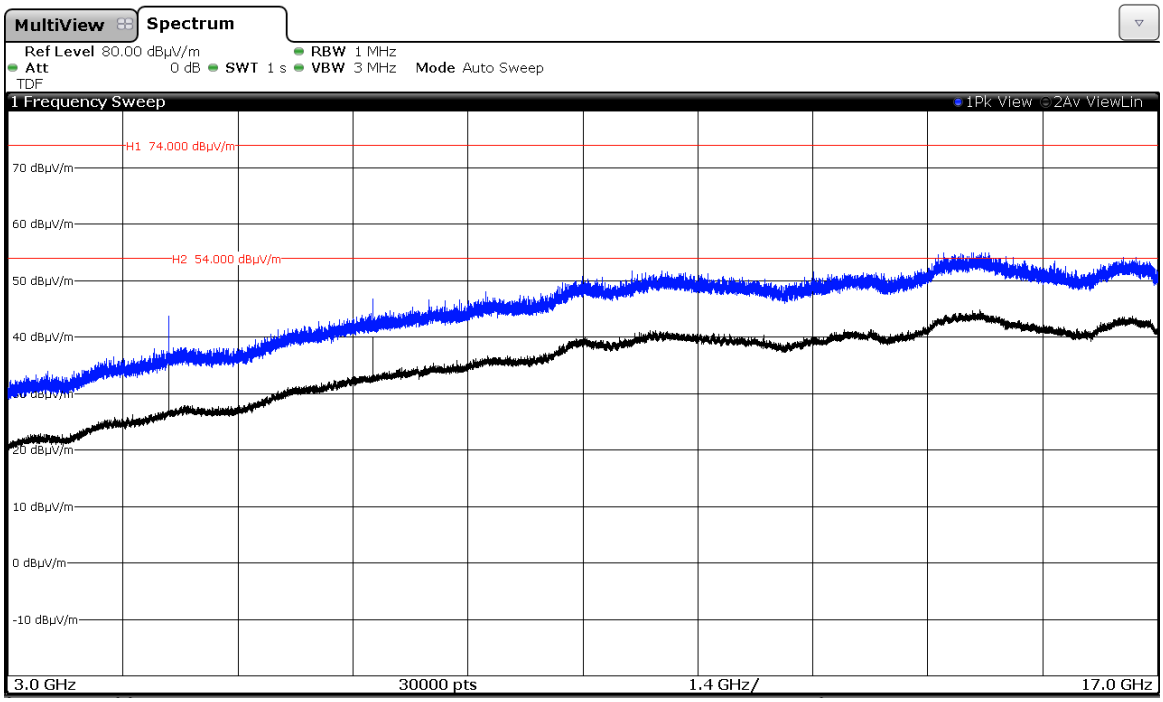
CHANNEL: Lowest (2402 MHz).



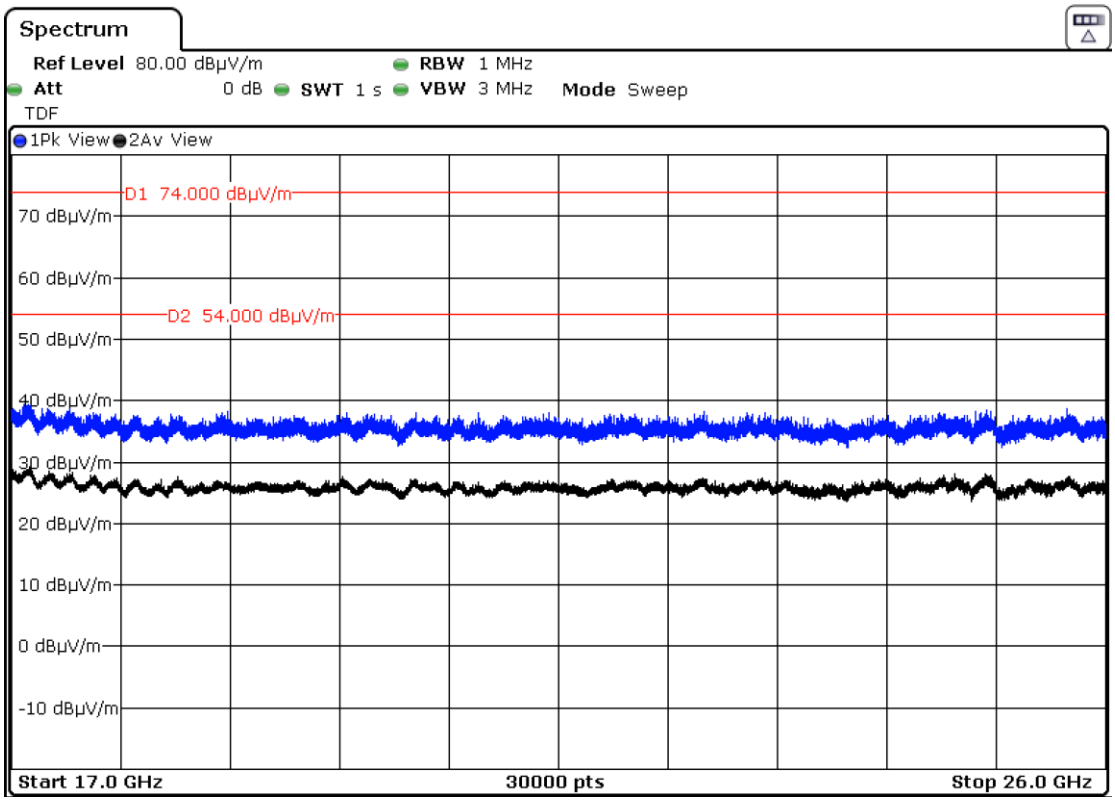
CHANNEL: Middle (2440 MHz).



CHANNEL: Highest (2480 MHz).



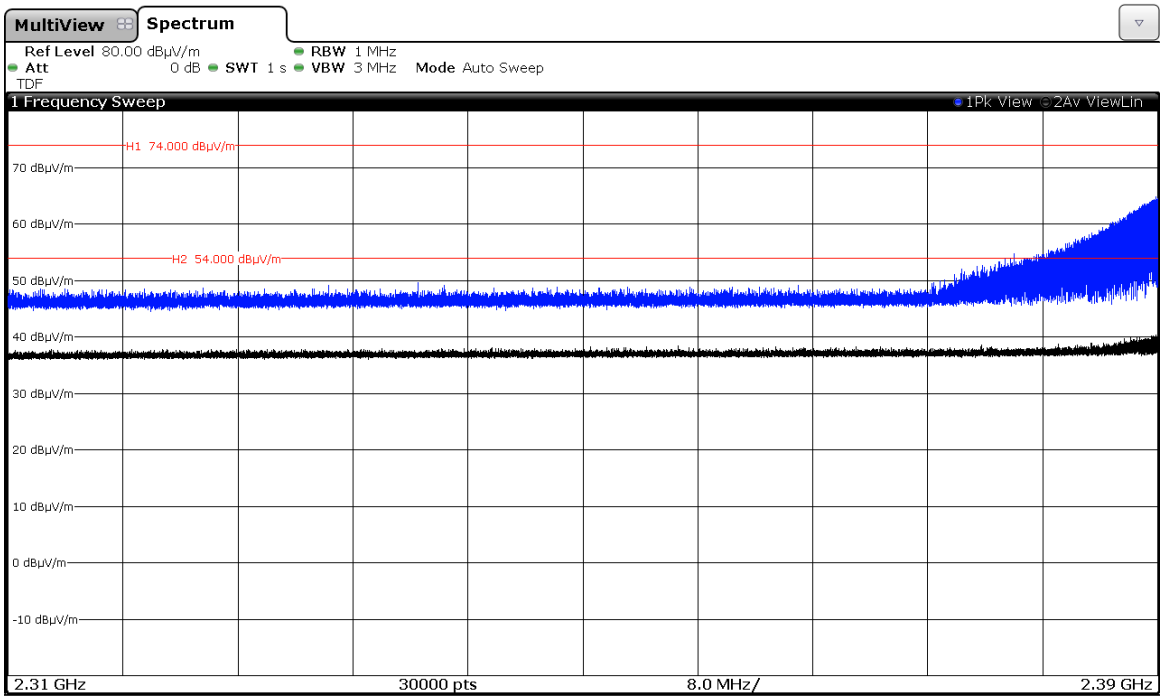
FREQUENCY RANGE 17 GHz to 26 GHz.



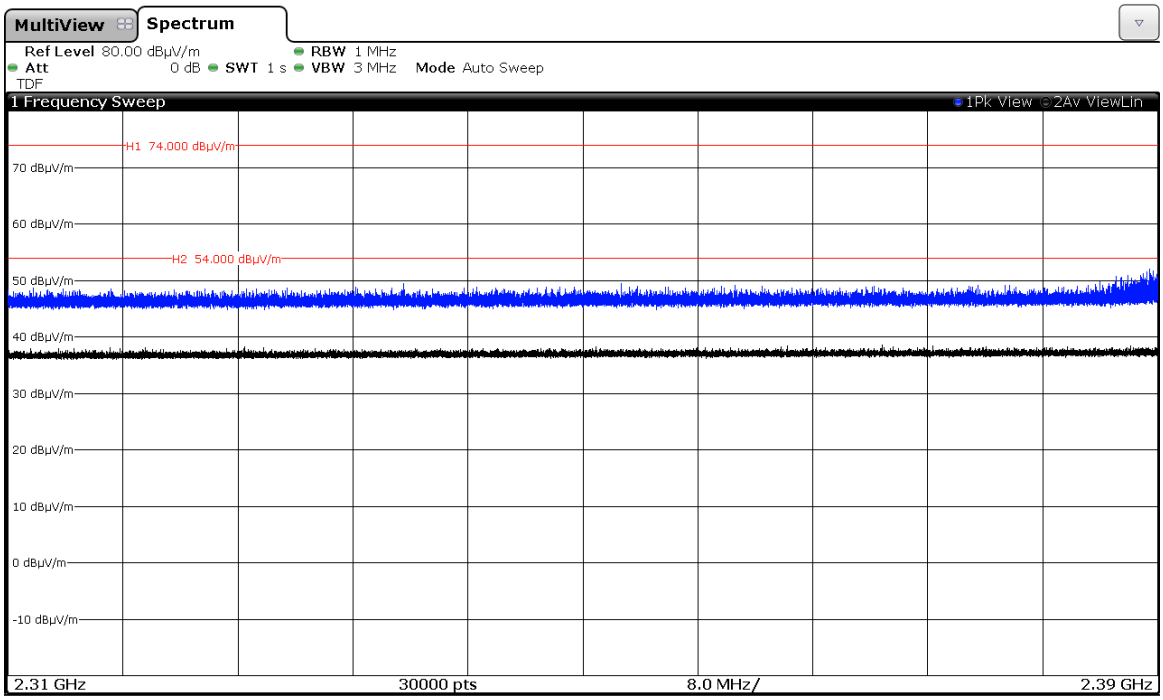
(This plot is valid for all three channels).

FREQUENCY RANGE 2.31 GHz to 2.39 GHz. (RESTRICTED BAND)

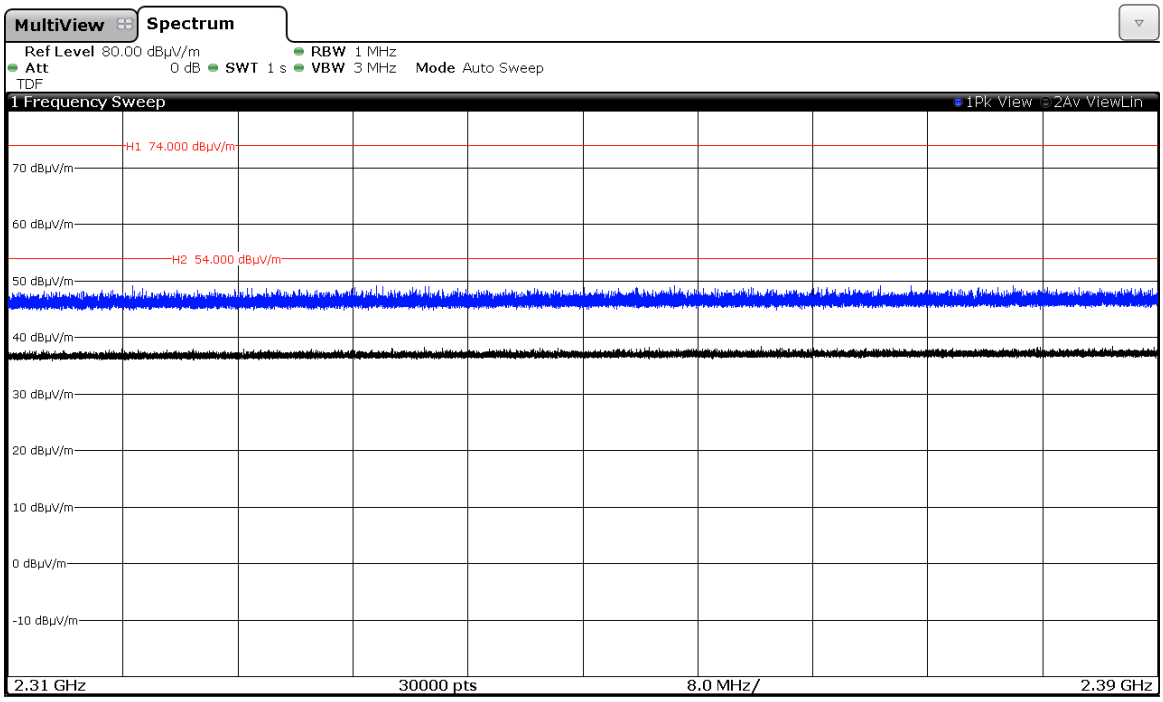
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2440 MHz).

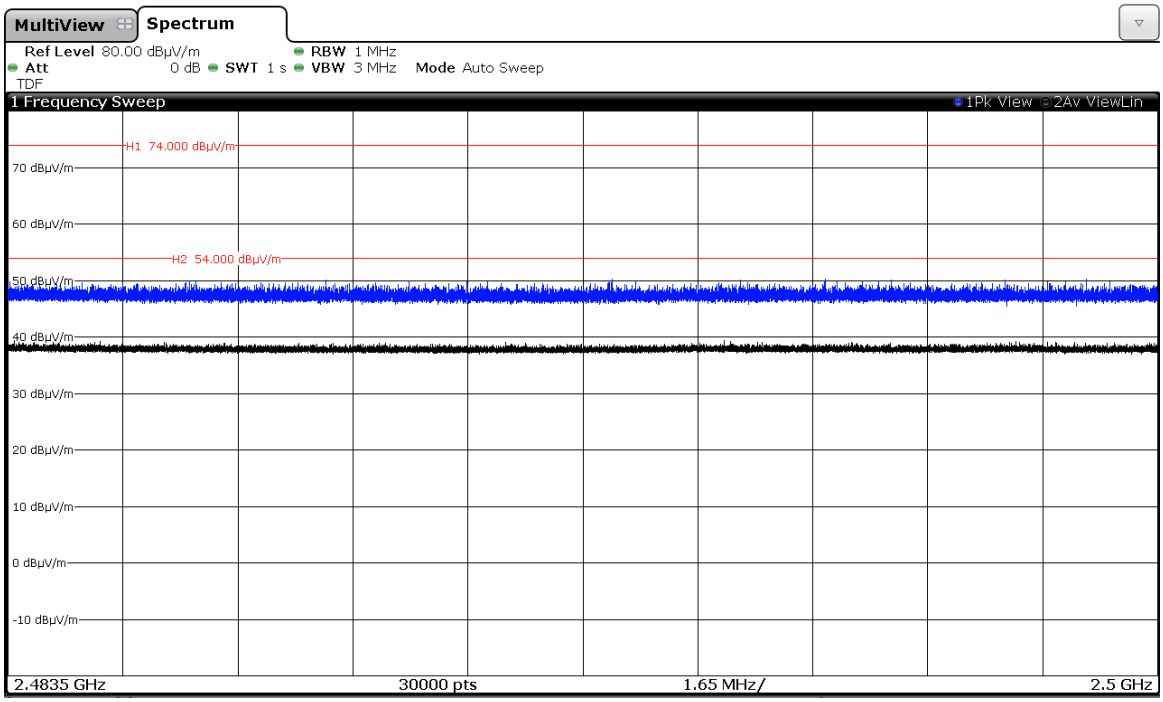


CHANNEL: Highest (2480 MHz).

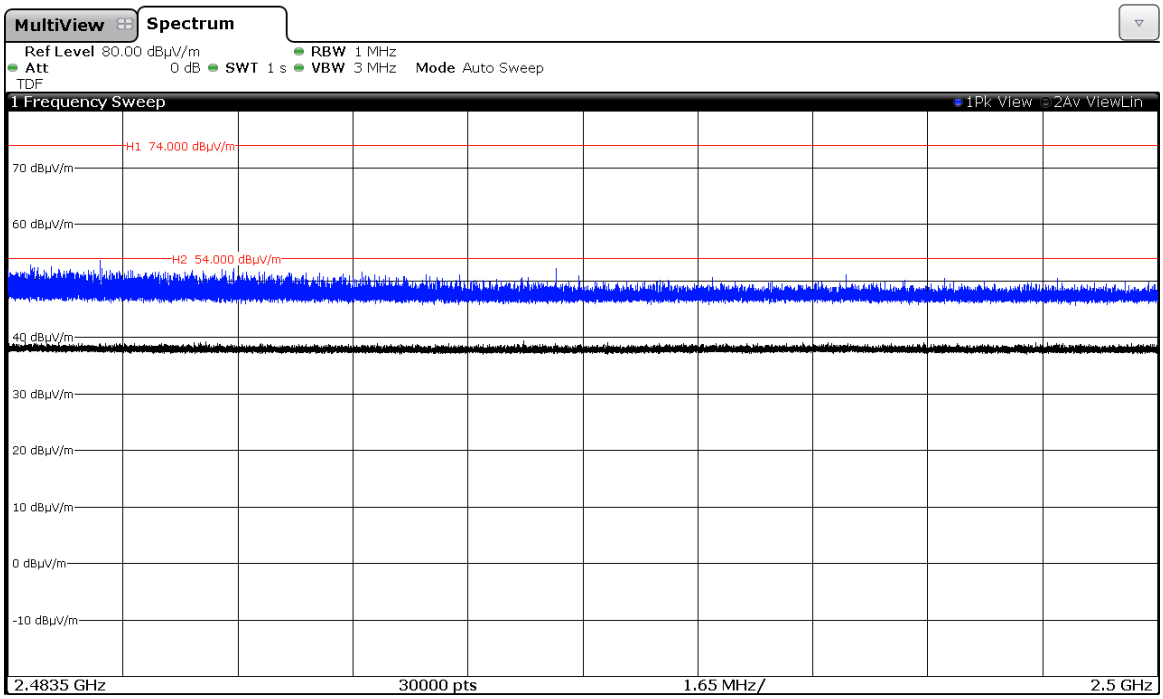
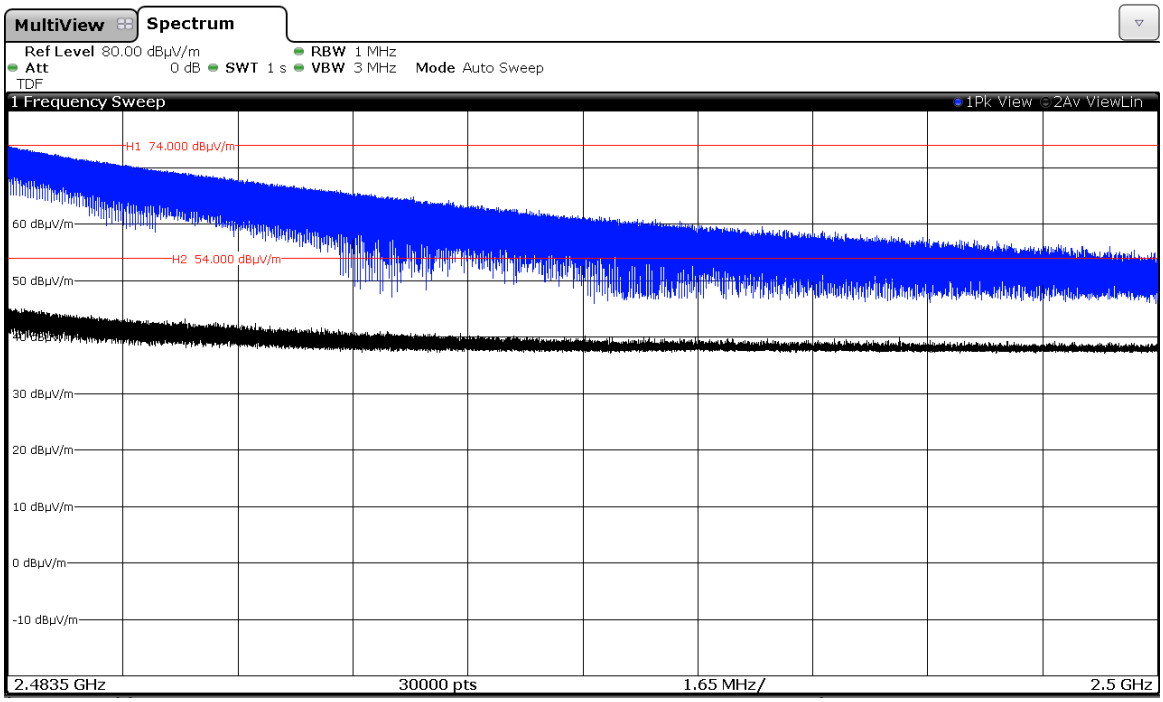


FREQUENCY RANGE 2.4835 GHz to 2.5 GHz. (RESTRICTED BAND).

CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2440 MHz).



CHANNEL: Highest (2480 MHz).